

C-4.6 Explain the role of activation energy and the effects of temperature, particle size, stirring, concentration, and catalysts in reaction rates.

Revised Taxonomy Levels 2.7 B Explain conceptual knowledge

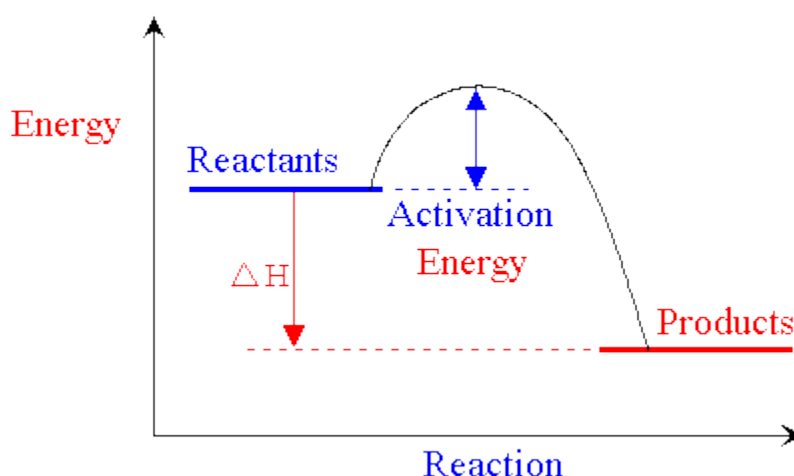
In physical science students

- ❖ Explain the effects of temperature, concentration, surface area, and the presence of a catalyst on reaction rates. (PS-4.11)
 - This is addressed in a descriptive manner in physical science

It is essential for students to

- ❖ Analyze an energy level diagram

Energy Level Diagram



The change in energy can be plotted against the progress of a reaction, as the reactants turn into products.

- Going from reactants to the top of the curve, you are going up the energy scale.
 - Energy (heat) is being put in to break bonds in the reactants.
 - At the top of the curve, the bonds in the reactants have been broken.
- The amount of energy put in to break these bonds is called the activation energy.
- The activation energy is the minimum amount of energy needed for the reaction to occur.

- ❖ Relate activation energy to heat of reaction
 - Going from the top of the curve to the products, you are going down the energy scale.
 - Energy (heat) is given out as bonds form in the products.
 - The reactants are higher up the energy scale than are the products.
 - The amount of energy (heat) you need to put in (the activation energy) is less than the amount of energy (heat) you get out.
 - This is a typical exothermic reaction.
 - The difference in energy levels between the reactants and the products is given the symbol ΔH
 - This is the amount of heat given out (or taken in) during the reaction.
 - For an exothermic reaction, ΔH is negative.
 - For an endothermic reaction, ΔH is positive.
- ❖ Analyze the effects of temperature, particle size, stirring, concentration, and catalysts on reaction rates
 - For each factor students should be able to explain, in terms of the kinetic theory, how the factor influences the reaction rate in terms of
 - Collision energy
 - Collision frequency
 - Activation energy

Assessment

The verb, explain means that the major focus of assessment should be for students to “construct a cause and effect model”. In this case, assessments will ensure that students can model how each of the factors (temperature, particle size, stirring, concentration, and catalysts) influence the rate of a chemical reaction. Because the indicator is written as conceptual knowledge, assessments should require that students understand the “interrelationships among the basic elements within a larger structure that enable them to function together.” In this case, assessments must show that students can construct a cause and effect statement relating each of these factors affects the ability of molecules to break or form bonds.